Carnegie Mellon
Software Engineering Institute

Pittsburgh, PA 15213-3890

CMMI® – The Next Step in Process Improvement

NDIA Systems Engineering Conference

Mike Phillips
CMMI Program Manager

℠ SCAMPI, SCAMPI Lead Appraiser, and SEI are service marks of Carnegie Mellon University.
® CMMI, Capability Maturity Model, and CMM are registered in the U.S. Patent and Trademark Office by Carnegie Mellon University.

Sponsored by the U.S. Department of Defense
© 2003 by Carnegie Mellon University

A House in Four Hours

Start at t_0 **t_0 + 2hrs 45 min**

©Building Industry Association, San Diego, CA, 1997.

© 2003 by Carnegie Mellon University

Process Observations

Building the four-hour house as it parallels product development processes:

- Plan the work
- Monitor and measure the work
- Design before building the product
- Analyze and commit to the design
- Integrate the product
- Create team experience before, not during, the build
- Reuse knowledge of past designs and builds
- Utilize highly skilled staff

© 2003 by Carnegie Mellon University

CMMI Is Integration and Improvement

CMMI supports process integration and product improvement.

CMMI integrates multiple disciplines into one process-improvement framework that eliminates inconsistencies and reduces duplication.

CMMI provides a framework for introducing new disciplines as needs arise and therefore reduces the cost of implementing model-based improvement.

CMMI is designed to minimize the impact on legacy process improvement efforts and investment.

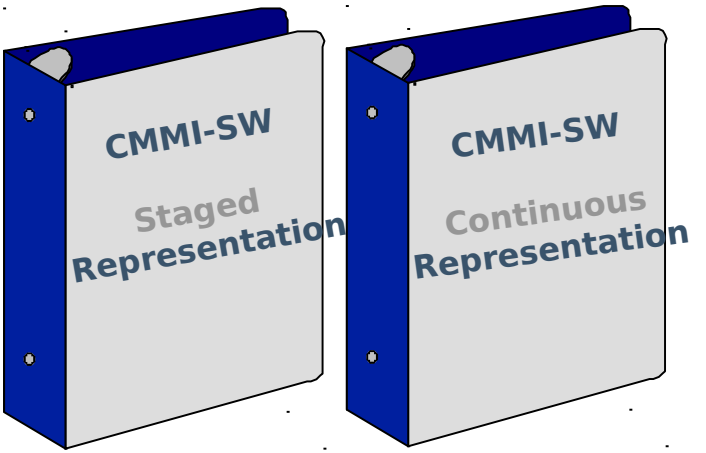
© 2003 by Carnegie Mellon University

CMMI Models

Source Models

- Capability Maturity Model®
  for Software V2, draft C

  (SW-CMM V2C)
- EIA 731, System Engineering Capability Model (SECM)
- Integrated Product Development Capability Maturity Model, draft V0.98 (IPD-CMM)



CMMI

- Meets the needs of software organizations
- Is an upgrade of SW-CMM
- Benefits from best practices contributed from all three source models

© 2003 by Carnegie Mellon University

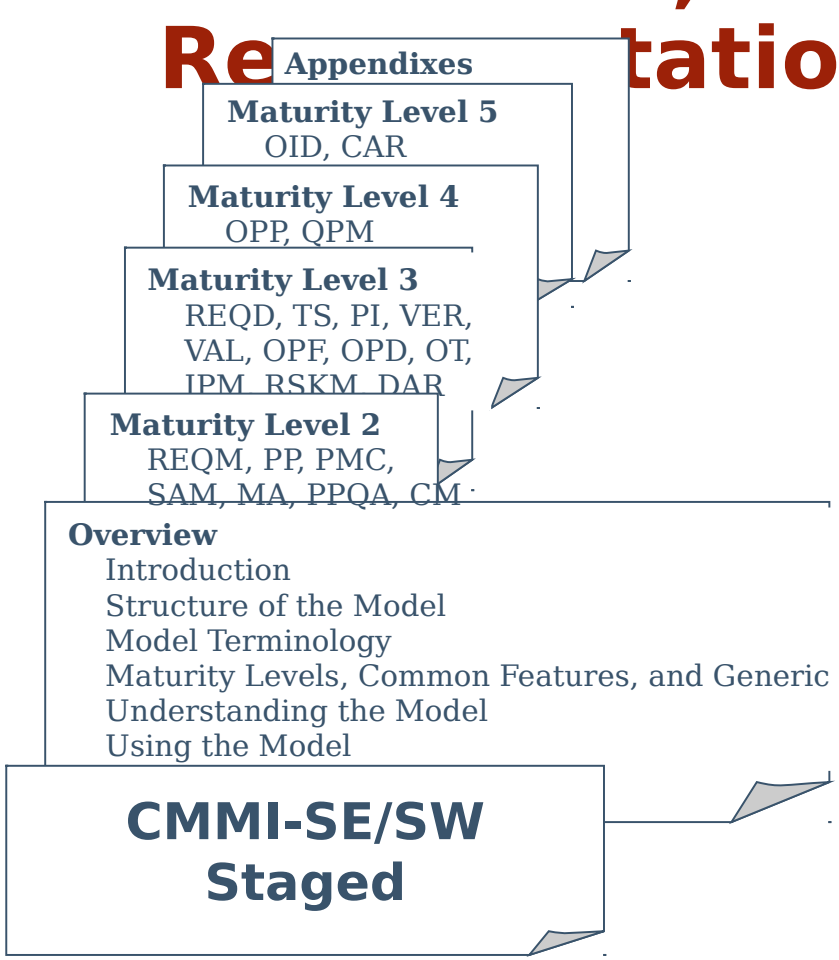
Improving on the Software CMM

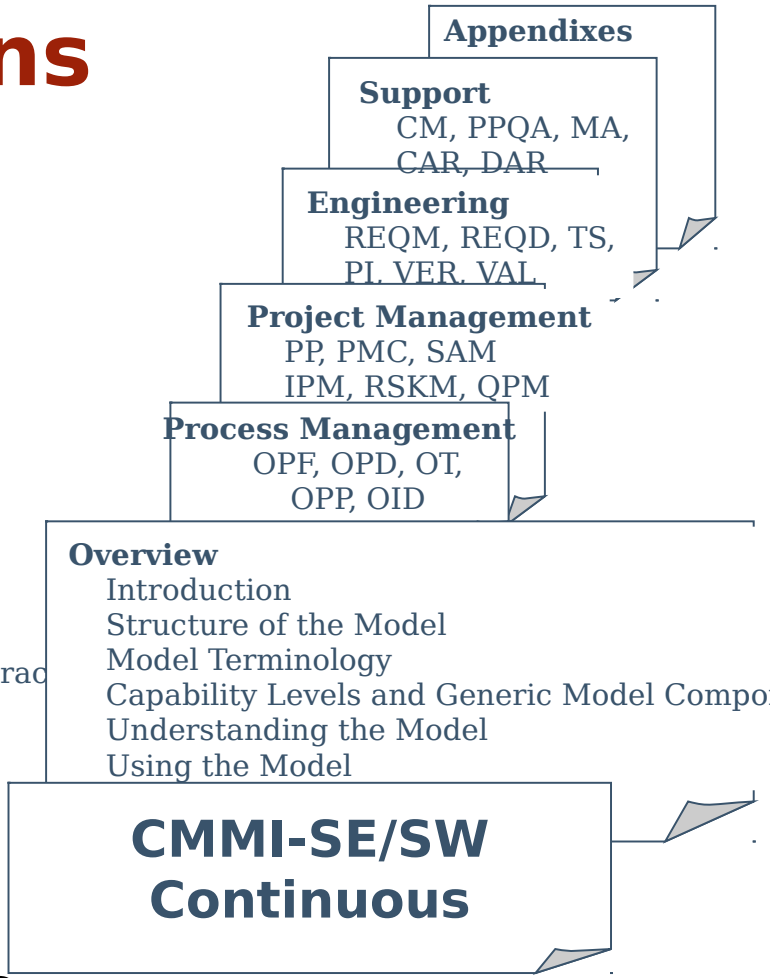
CMMI Models improve on SW-CMM Version 2.0 Draft C:

- Incorporate additional years of learning
- More explicitly link best practices to business objectives
- Expand the scope of and visibility into the product life cycle and engineering activities
- Add more best practices, (e.g., measurement, risk management, product integration, decision analysis and resolution, and supplier management)
- Capture more robust high-maturity practices
- Address additional generic practices needed for institutionalization
- More fully comply with relevant ISO standards

© 2003 by Carnegie Mellon University

One Model, Two Representations





© 2003 by Carnegie Mellon University

Understanding CMMI Representations

A representation allows an organization to pursue different improvement objectives and presents model components differently. The content is nearly identical in both representations.

So why both?

- The representation of each source model was different
  - Software CMM—Staged
  - SE-CMM, SECM—Continuous
- Ease adoption by legacy communities.
- Both representations provide inherent benefits.

© 2003 by Carnegie Mellon University

Advantages of Each Representation

Continuous Representation	Staged Representation
Provides maximum flexibility for order of process improvement	Predefined and proven path with case study and ROI data
High visibility of improvement within process areas	Focuses on organizational improvement
Easy upgrade from EIA 731	Easy upgrade from SW-CMM
Easy comparison to ISO 15504	Provides familiar benchmarking capability
Improvement of process areas can occur at different rates	Overall results summarized in a maturity level

© 2003 by Carnegie Mellon University

CMMI in a Nutshell

A CMMI model provides a structured view of process improvement across an organization.

CMMI can help

- set process improvement goals and priorities
- provide guidance for quality processes
- provide a yardstick for appraising current practices

© 2003 by Carnegie Mellon University

CMMI Today

Stable Version 1.1 CMMI Product Suite was released January 2002.

CMMI models will not change until 2005 at earliest.

Many defense, aerospace, and commercial organizations are upgrading to CMMI.

One appraisal method, SCAMPI, covers

- internal process improvement
- supplier source selection
- contract process monitoring

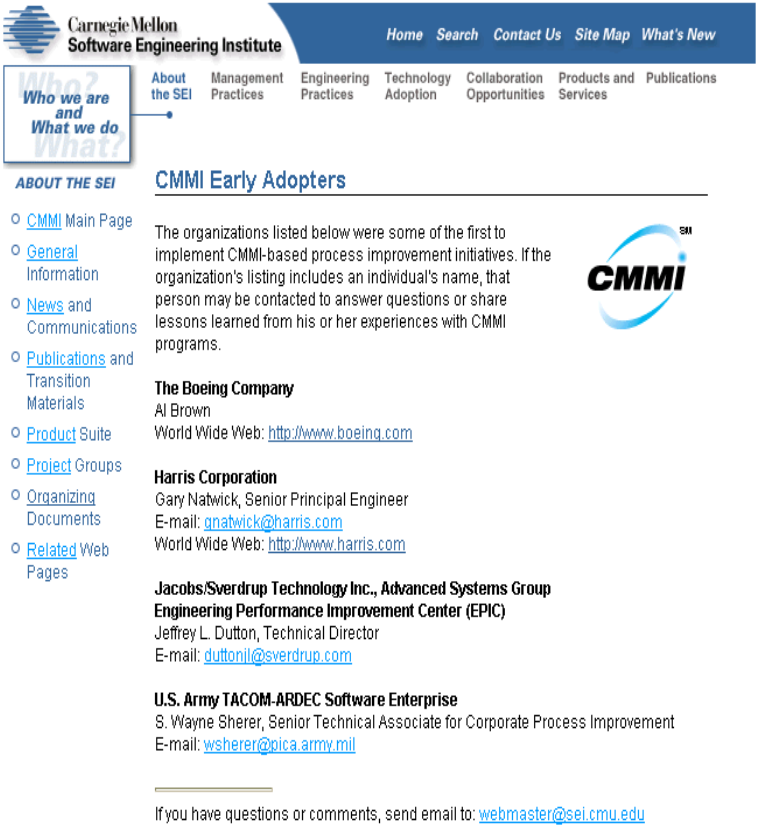
© 2003 by Carnegie Mellon University

Early Adopters

Currently there are 30+ early adopters.

Are you an early adopter? Send email to cmmi-comments@sei.cmu.edu to be listed.

See Early Adopter list at http://www.sei.cmu.edu/cmmi/adoption/early-adopters.html



Carnegie Mellon
Software Engineering Institute

Home | Search | Contact Us | Site Map | What's New

About the SEI | Management Practices | Engineering Practices | Technology Adoption | Collaboration Opportunities | Products and Services | Publications

Who we are and What we do

ABOUT THE SEI

- CMMI Main Page
- General Information
- News and Communications
- Publications and Transition Materials
- Product Suite
- Project Groups
- Organizing Documents
- Related Web Pages

CMMI Early Adopters

The organizations listed below were some of the first to implement CMMI-based process improvement initiatives. If the organization's listing includes an individual's name, that person may be contacted to answer questions or share lessons learned from his or her experiences with CMMI programs.

The Boeing Company
Al Brown
World Wide Web: http://www.boeing.com

Harris Corporation
Gary Natwick, Senior Principal Engineer
E-mail: gnatwick@harris.com
World Wide Web: http://www.harris.com

Jacobs/Sverdrup Technology Inc., Advanced Systems Group Engineering Performance Improvement Center (EPIC)
Jeffrey L. Dutton, Technical Director
E-mail: duttonjl@sverdrup.com

U.S. Army TACOM-ARDEC Software Enterprise
S. Wayne Sherer, Senior Technical Associate for Corporate Process Improvement
E-mail: wsherer@pica.army.mil

If you have questions or comments, send email to: webmaster@sei.cmu.edu

© 2003 by Carnegie Mellon University

Discoveries in Use

Ease of upgrade to CMMI reported by:

- Multiple SW-CMM level 5 organizations that upgraded and maintained their maturity level
- Multiple organizations that upgraded from EIA 731 systems engineering assessments
- Numerous European companies in group discussion of CMMI adoption at recent SEI-Europe quarterly meeting

Appraisal times reflect excellent learning curves

- Australian group reported 40% reduction in appraisal time as learning occurred over five appraisals

Mappings and gap analyses confirm evolutionary expansion from predecessor models

- Government and contractors agree on CMMI's improved engineering coverage in contract monitoring
- ISO/CMMI compatibility appears favorable

© 2003 by Carnegie Mellon University

Where We're Going

Adoption activities
- Transition Partner data
- Workshops, technical notes, and book publication
- Interpretive Guidance project

Appraisal enhancement activities
- SCAMPI appraisal data
- CMMI appraisals conducted worldwide
- SCAMPI enhancements

Training activities
- CMMI training data
- Training course upgrades

© 2003 by Carnegie Mellon University

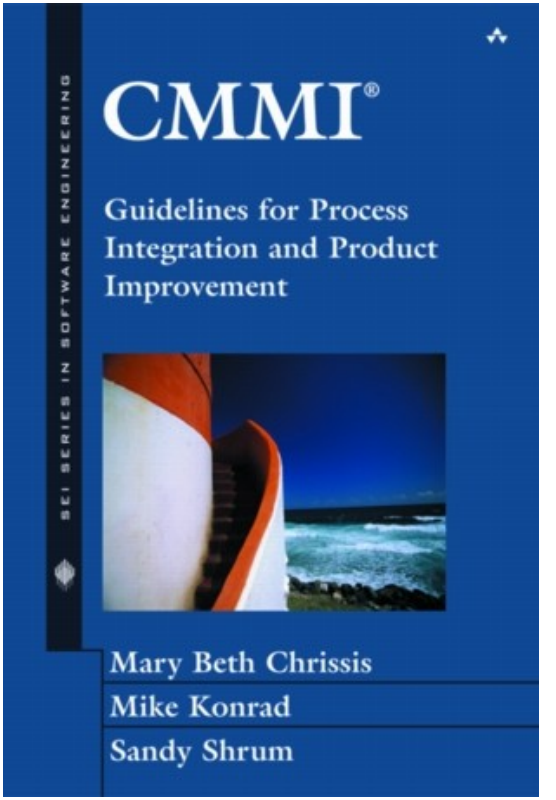
Adoption—What's Happening Now

Events related to CMMI adoption:
- Quarterly transition workshops
- Annual NDIA/SEI CMMI User Workshop

Interpretive Guidance project

Technical notes and special reports:
- CMMI and Product Line Practices
- CMMI and Earned Value Management
- Interpreting CMMI for Operational Organizations
- Interpreting CMMI for Service Organizations (in progress)
- CMMI Mappings
- Specific interests (e.g., safety, security)

Publication of SEI Series Book with Addison-Wesley



© 2003 by Carnegie Mellon University

CMMI Transition Status

As of 9/30/03

Training

- **Introduction to CMMI – 9354 trained**
- **Intermediate CMMI - 684 trained**
- **Introduction to CMMI Instructors - 190 trained**
- **SCAMPI Lead Appraisers - 299 trained**

Authorized

- **Introduction to CMMI V1.1 Instructors - 152**
- **SCAMPI V1.1 Lead Appraisers – 225**

© 2003 by Carnegie Mellon University

SCAMPI℠ Version 1.1 Appraisals

93	Appraisals
87	Organizations
46	Participating companies
12	Countries
55%	Non-U.S. organizations

Analysis conducted July 10, 2003

© 2003 by Carnegie Mellon University

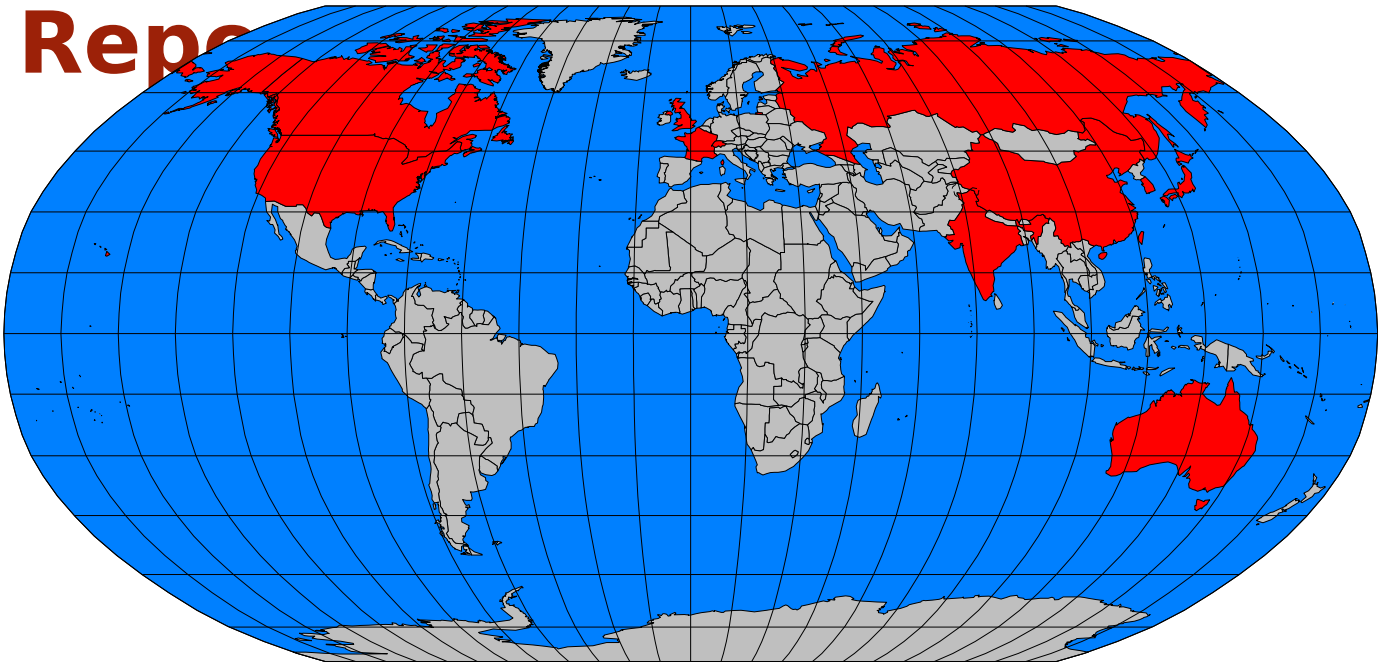
Where are the Appraisal Results Coming From?

87 Organizations

- Commercial 41
- DoD Contractor 30
- Civil Contractor 8
- Military Org 2
- Civil Org 2
- In House Dev 3

© 2003 by Carnegie Mellon University

Countries where Appraisals have been Performed and Repo



Australia
Canada
China
France
India
Japan
Korea, Republic of
Russia
Switzerland
Taiwan
United Kingdom
United States

© 2003 by Carnegie Mellon University

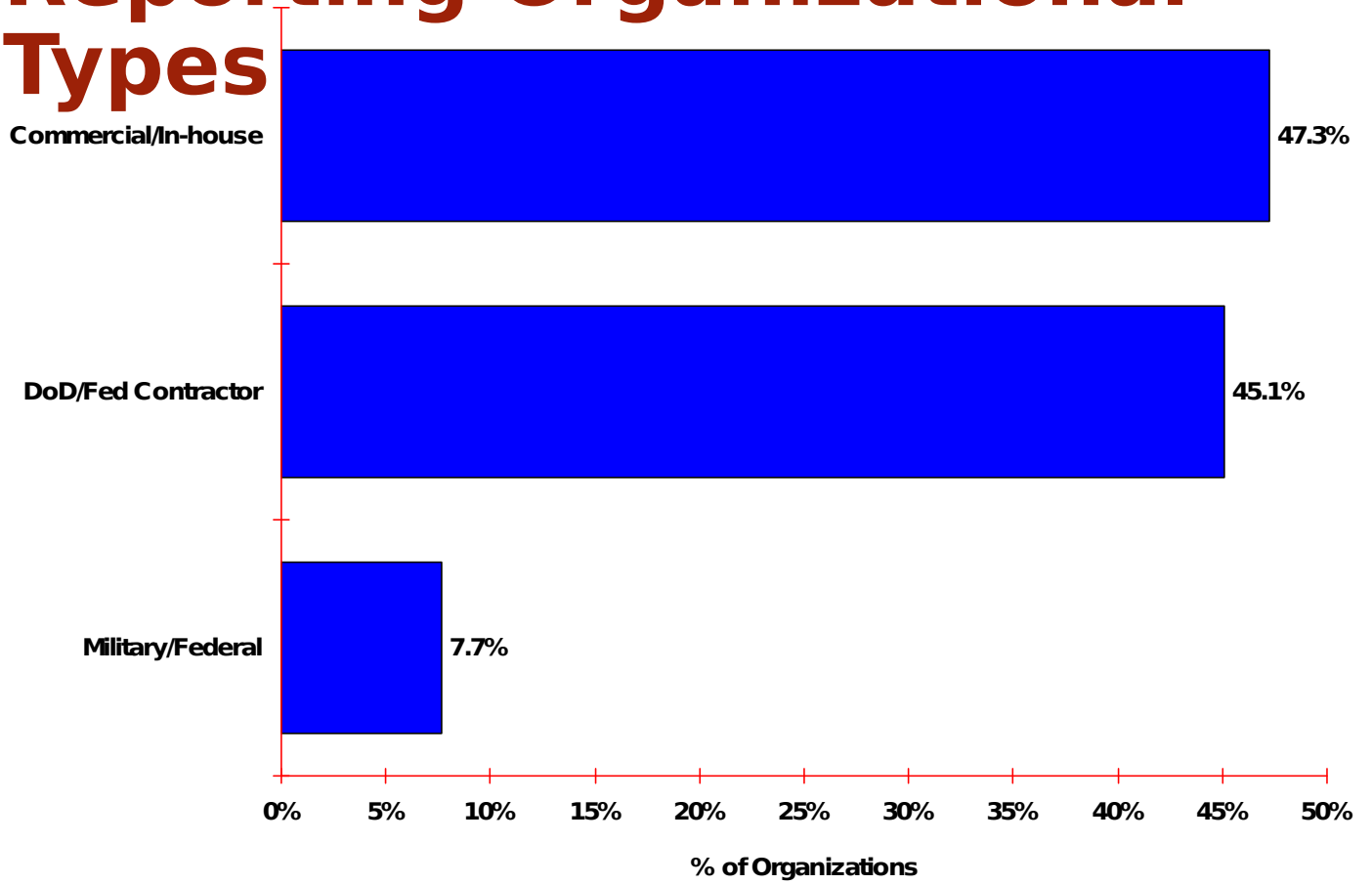
Geographic Distribution of Appraisal Results

Countries

- USA 39
- Japan 21
- India 9
- United Kingdom 5
- Australia 3
- China 2
- France 2
- Taiwan 2
- Canada 1
- Russia 1
- South Korea 1
- Switzerland 1

© 2003 by Carnegie Mellon University

Reporting Organizational Types

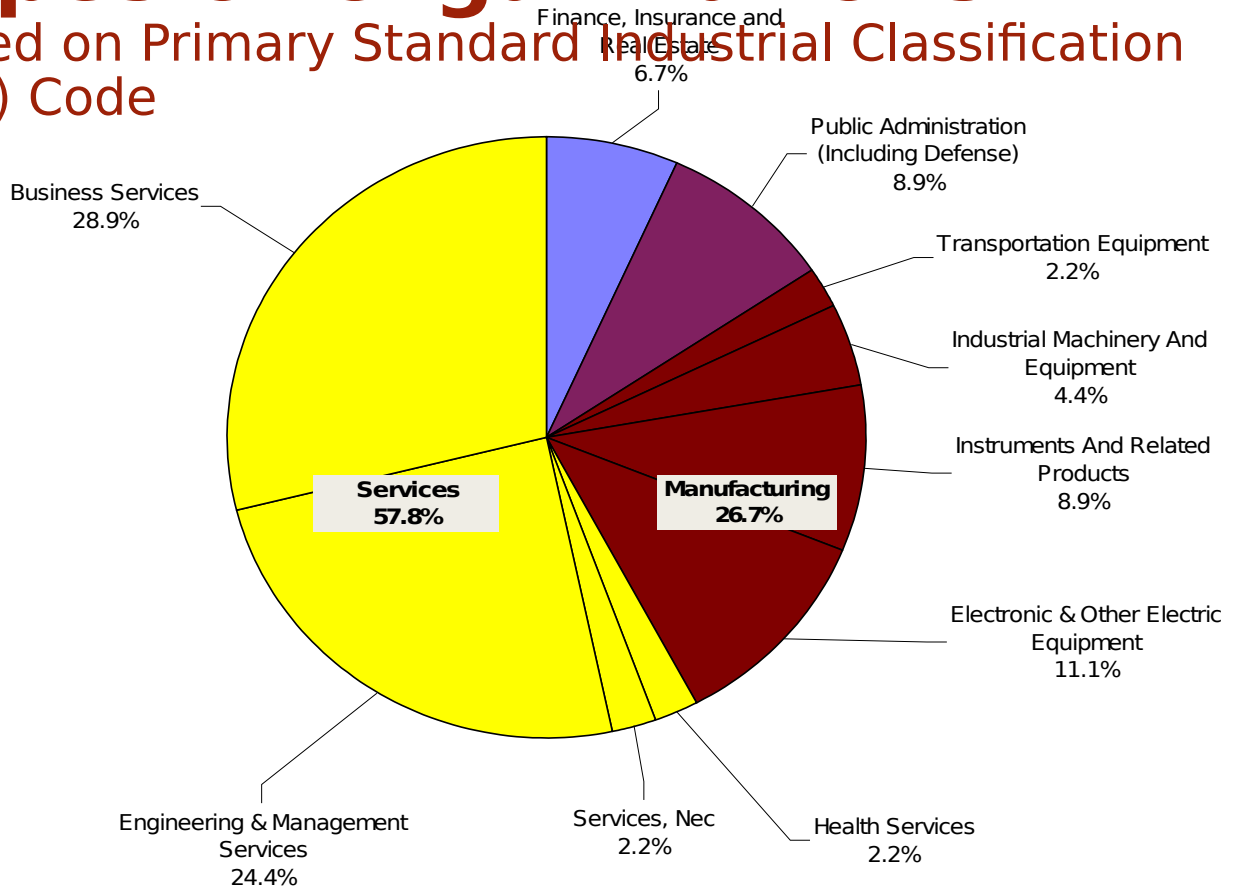


Based on 91 organizations

© 2003 by Carnegie Mellon University

Types of Organizations

Based on Primary Standard Industrial Classification (SIC) Code

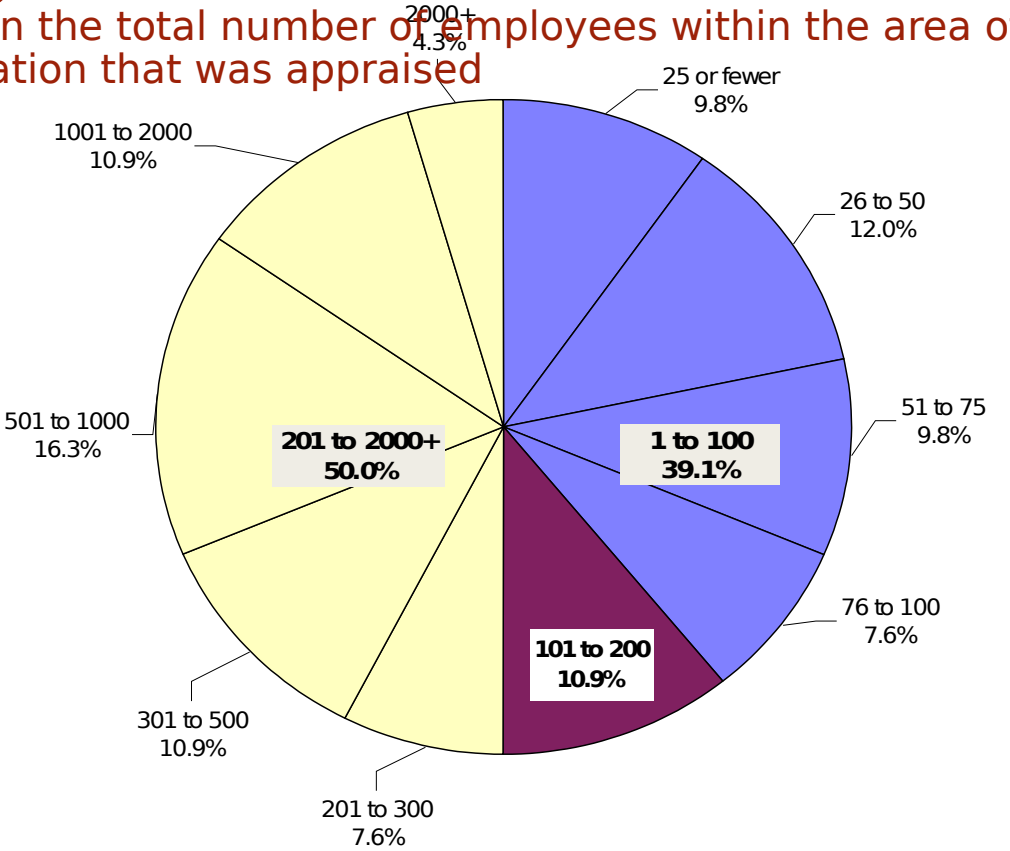


Based on 45 organizations reporting SIC code. For more information visit: http://www.osha.gov/oshstats/sicser.html

© 2003 by Carnegie Mellon University

Organizational Size

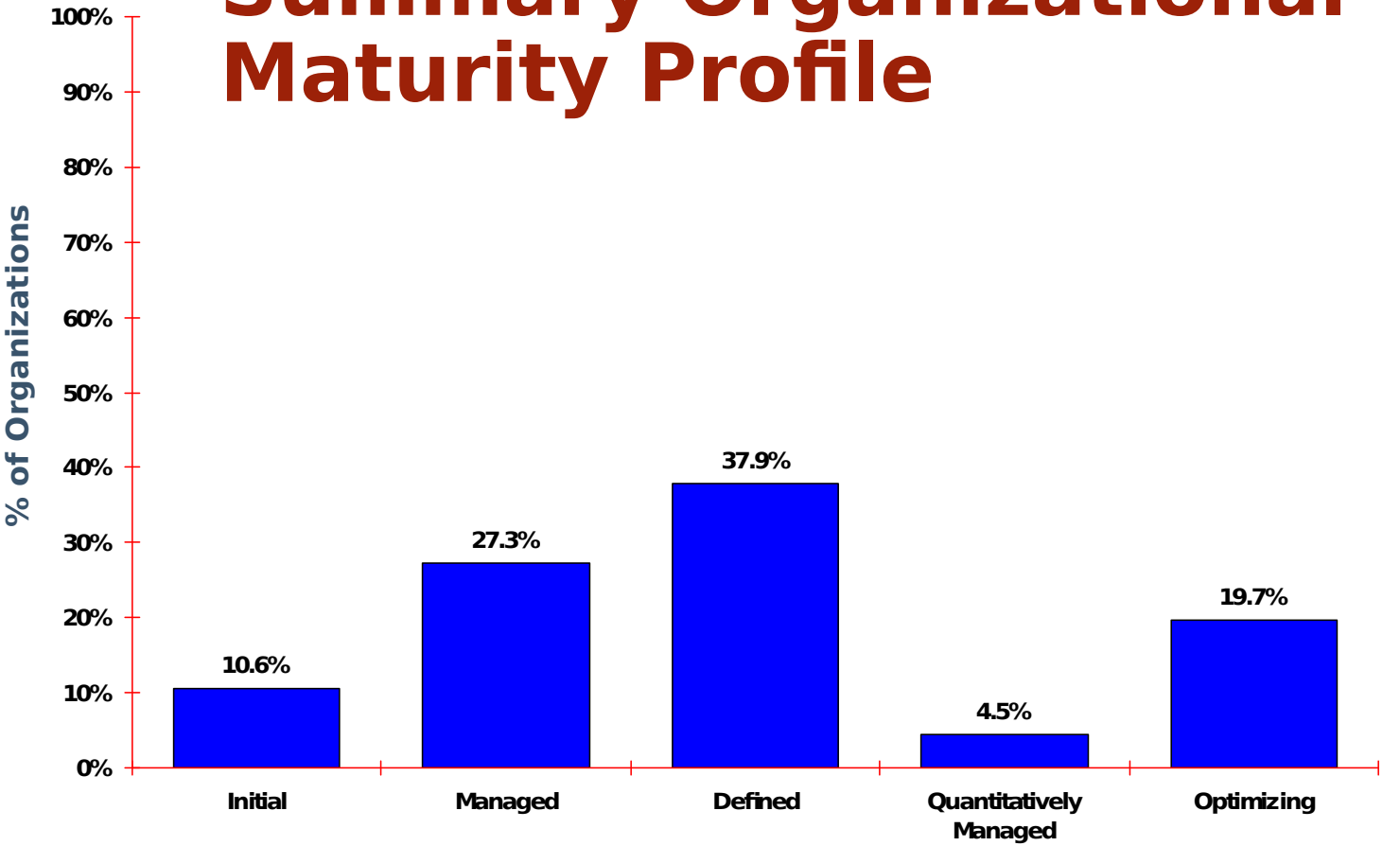
Based on the total number of employees within the area of the organization that was appraised



Based on **92** organizations reporting size data

© 2003 by Carnegie Mellon University

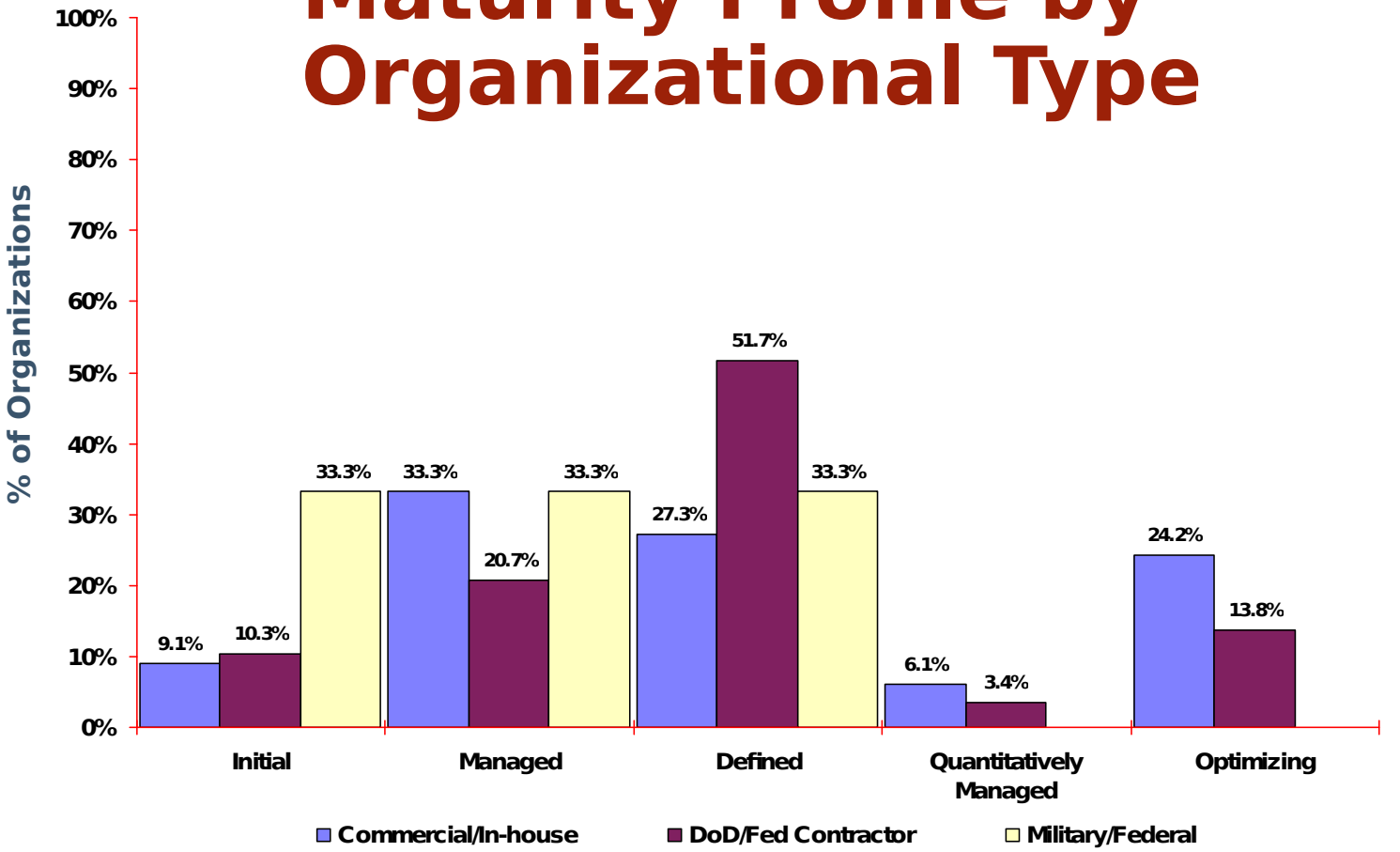
Summary Organizational Maturity Profile



Based on most recent appraisal of organizations reporting a maturity level rating

© 2003 by Carnegie Mellon University

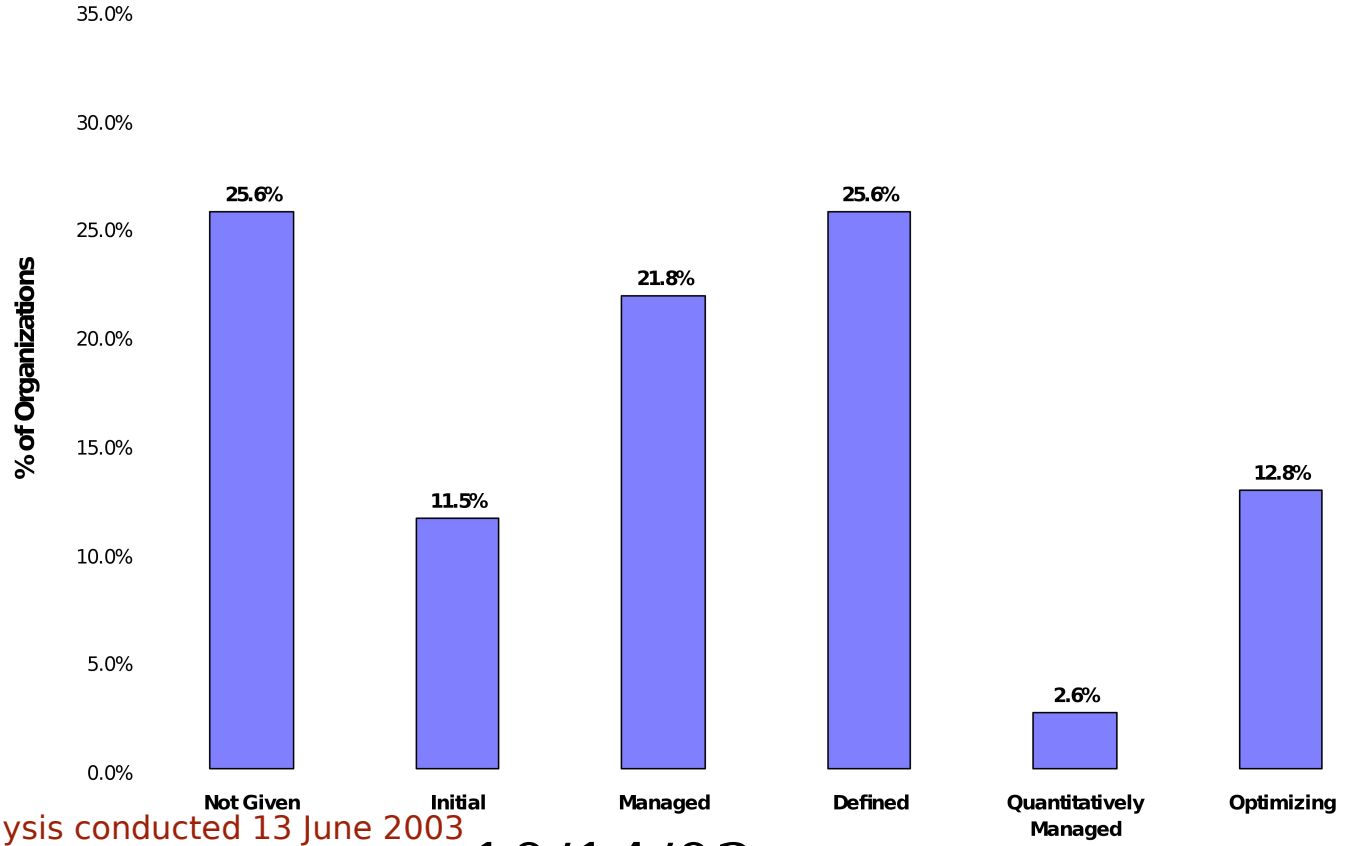
Maturity Profile by Organizational Type



Based on most recent appraisal of organizations reporting organization type and a maturity level rating

© 2003 by Carnegie Mellon University

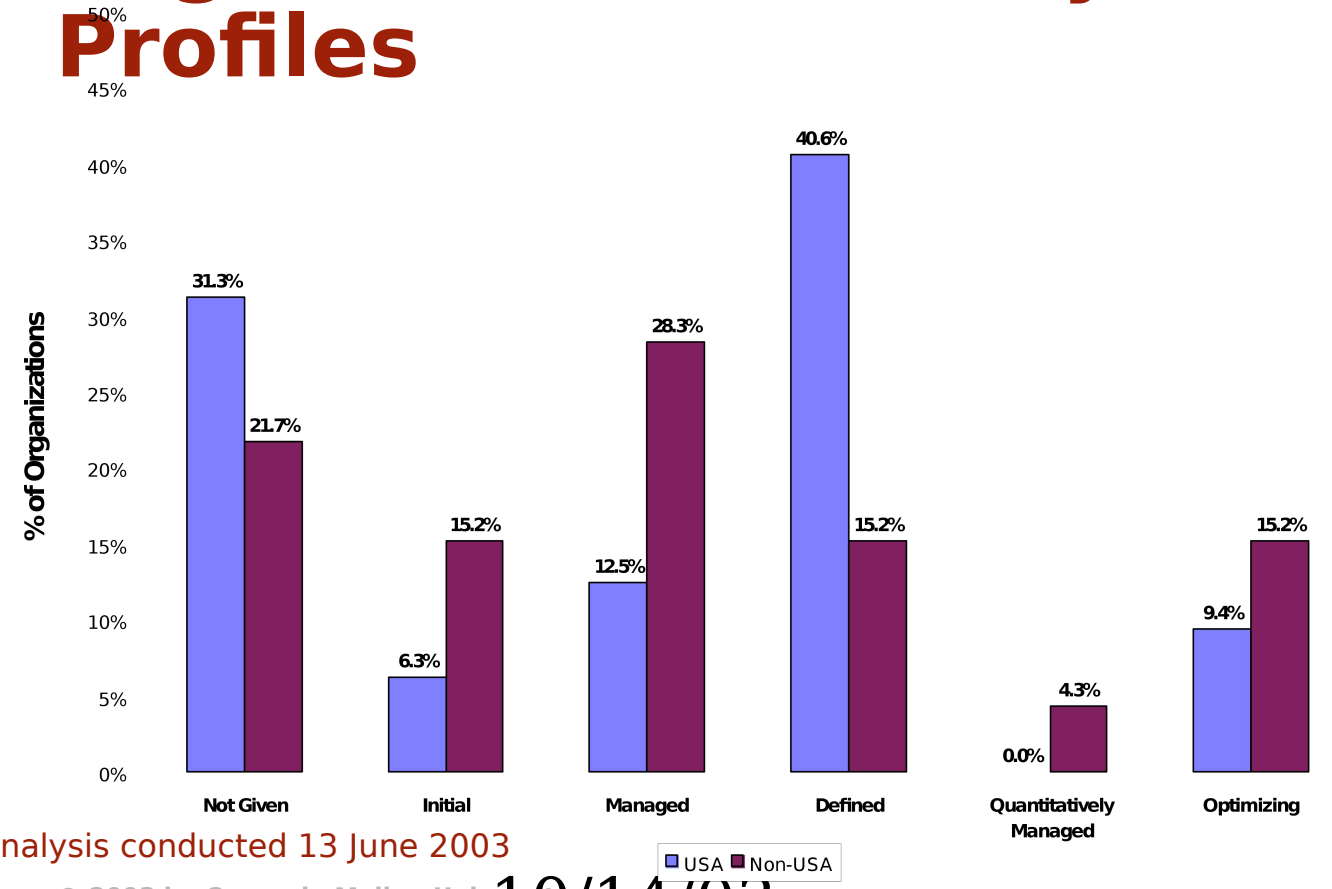
Organization Maturity Profile



Analysis conducted 13 June 2003

© 2003 by Carnegie Mellon University

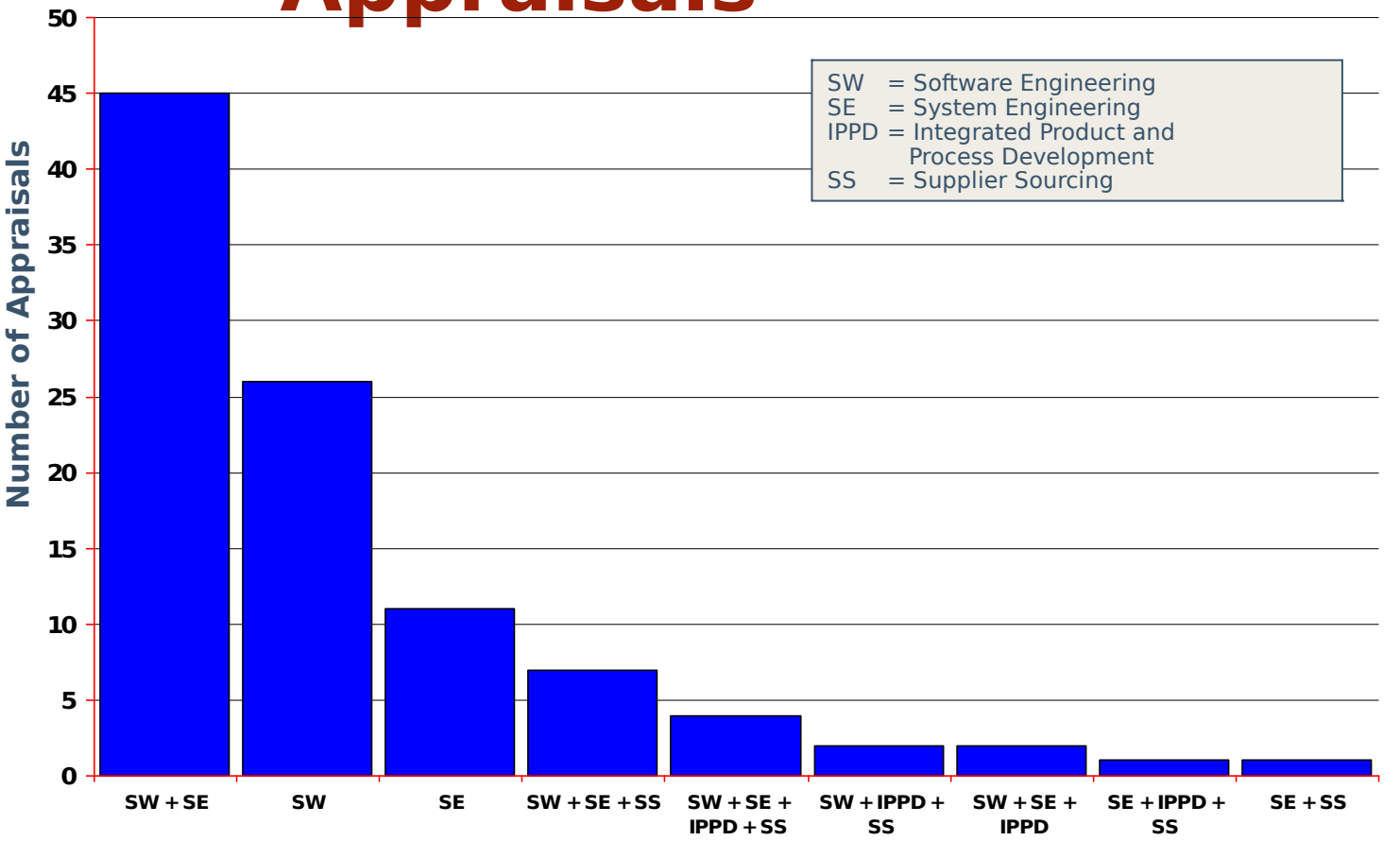
U.S. and Non-U.S. Organization Maturity Profiles



Analysis conducted 13 June 2003

© 2003 by Carnegie Mellon University

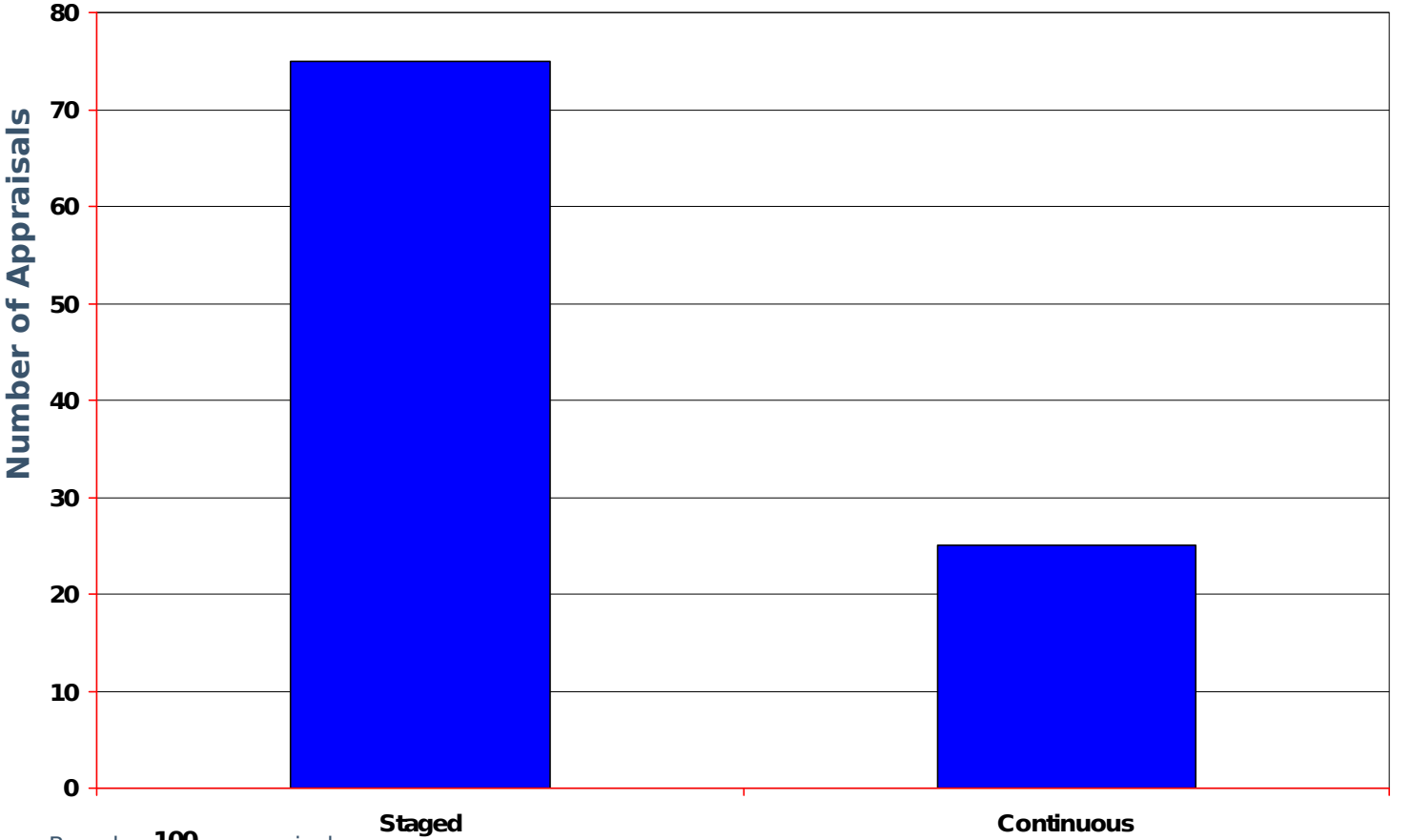
Disciplines Selected for Appraisals



Based on 99 appraisals reporting coverage

© 2003 by Carnegie Mellon University

Use of Model Representations in Appraisals



Based on 100 appraisals

© 2003 by Carnegie Mellon University

Change in Maturity Level Rating

Current Maturity Level

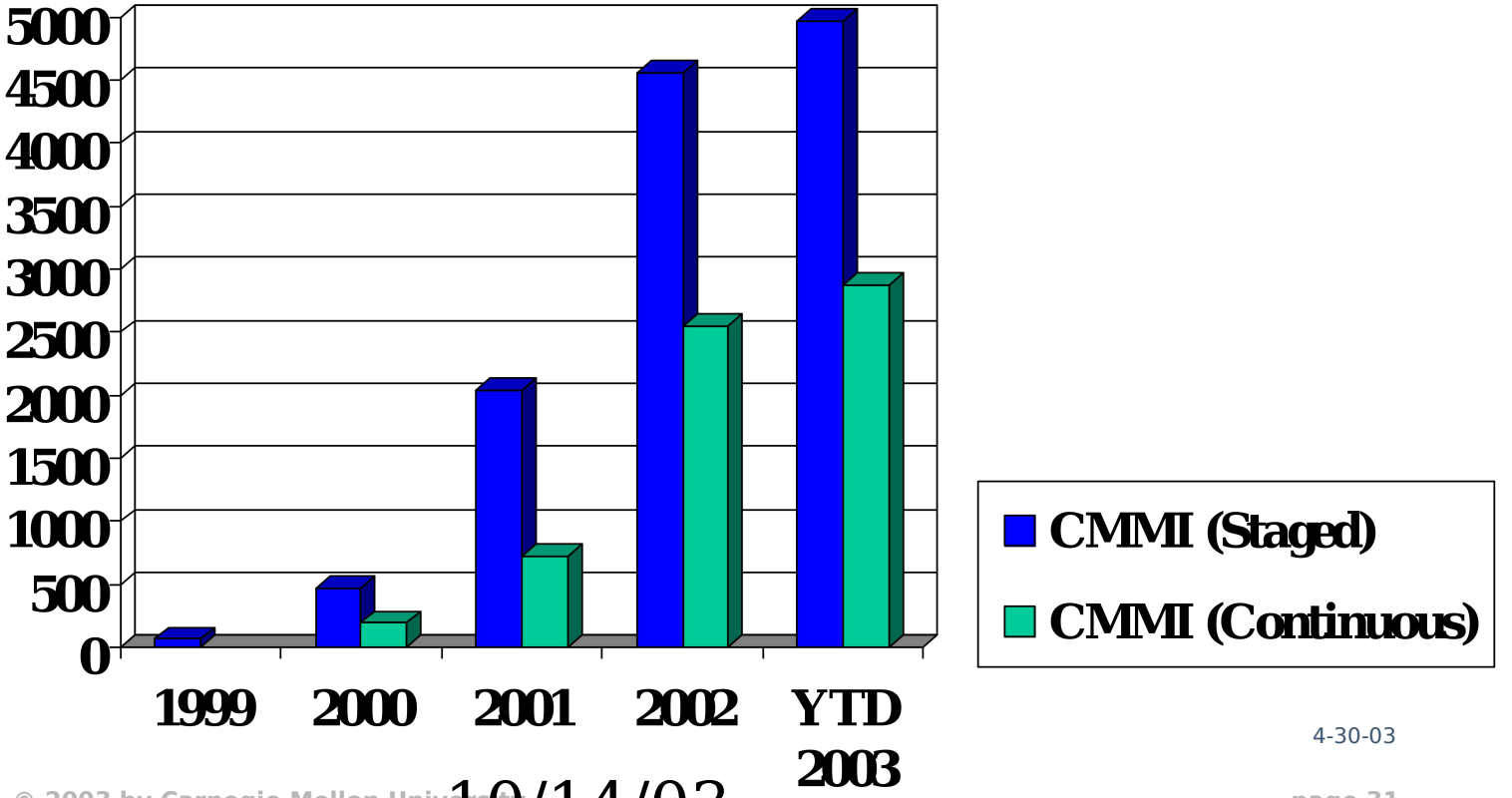
Prior Maturity Level

	1	2	3	4	5
1					
2			1		
3		1	2		
4					3
5					1

© 2003 by Carnegie Mellon University

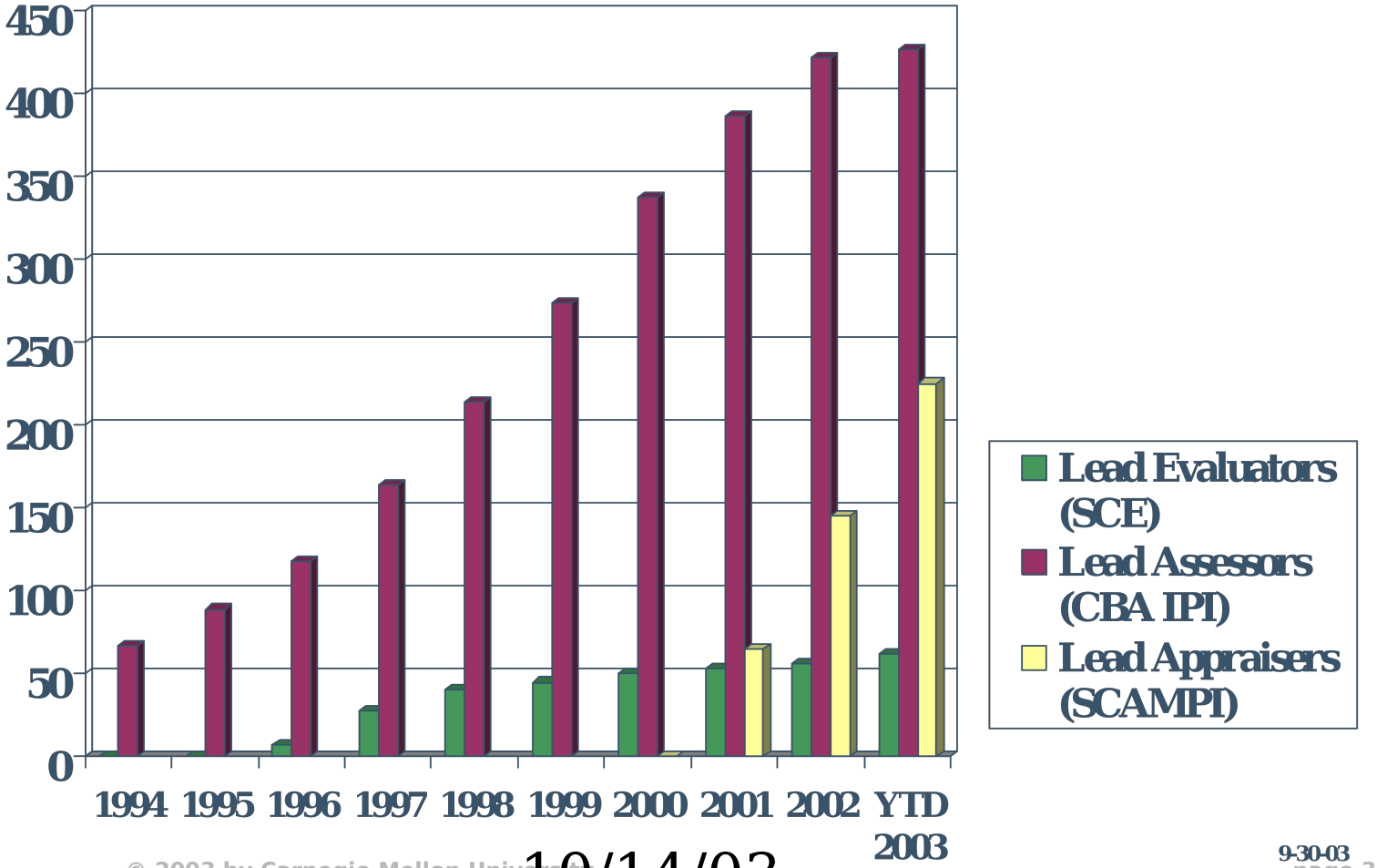
Note: these data are from Feb 2003.

Number of CMMI Students Trained (Cumulative)



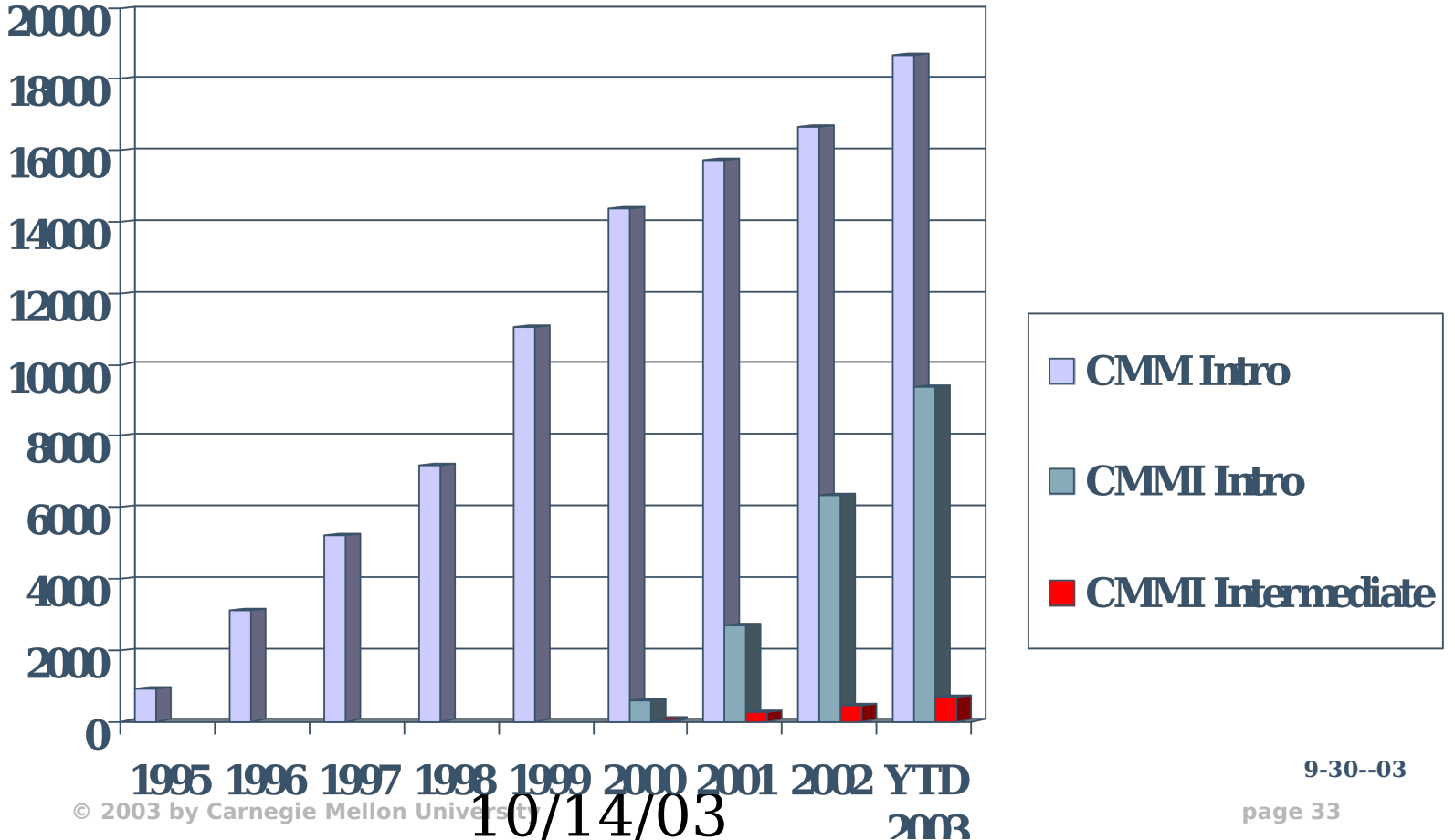
© 2003 by Carnegie Mellon University

Number of Lead Appraisers Authorized (Cumulative)

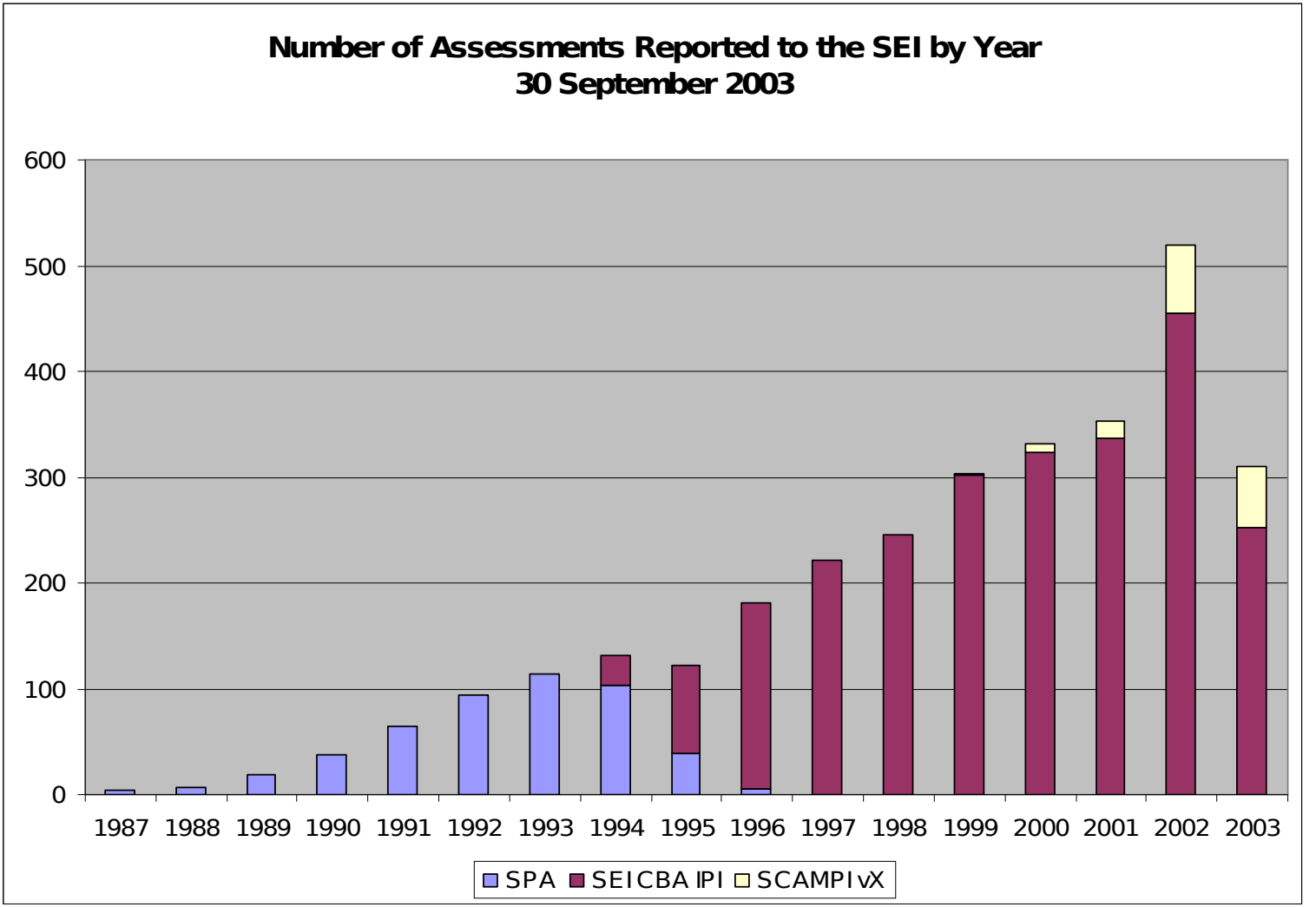


© 2003 by Carnegie Mellon University

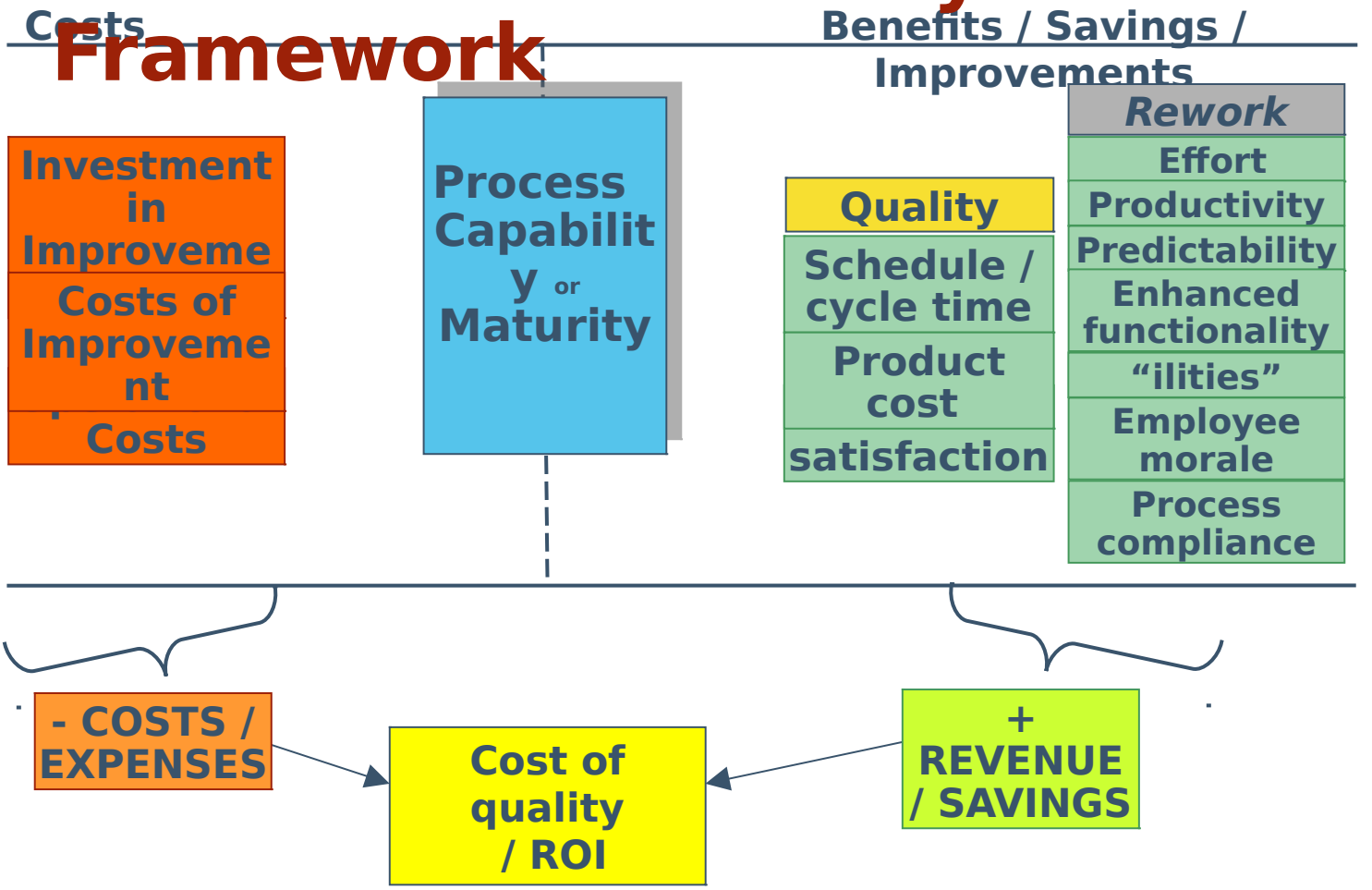
Intro to the CMM and CMMI Attendees (Cumulative)



© 2003 by Carnegie Mellon University


Number of Assessments Reported to the SEI by Year
30 September 2003
600
500
400
300
200
100
0
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
SPA
SEI CBA IPI
SCAMPI vX

CMMI® Results Study Framework



© 2003 by Carnegie Mellon University

Boeing, Australia

Making transition to CMMI from SW-CMM and EIA 731; early CMMI pilot in Australia

RESULTS on One Project

- 33% decrease in the average cost to fix a defect
- Turnaround time for releases cut in half
- 60% reduction in work from Pre-Test and Post-Test Audits; passed with few outstanding actions

Product cost

Schedule / cycle time

Quality

- Increased focus on product quality
- Increased focus on eliminating defects
- Developers seeking improvement opportunities

In Processes is there a Pay-Off? Terry Stevenson, Boeing Australia, Software Engineering Australia 2003 conference.

© 2003 by Carnegie Mellon University

Lockheed Martin M&DS

SW CMM ML2 (1993) to ML 3 (1996) to CMMI ML5 (2002)

Results

- Award Fees during 2002 are 45% percent unrealized award fees at ML2

Customer satisfaction

1996 - 2002

- Increased software productivity by 30%
- 16% reduction in Dollars/KLOC
- Decreased defect find and fix costs by 15%

Productivity

Product cost

Quality

Internal data shared through Collaboration; August 2003.

© 2003 by Carnegie Mellon University

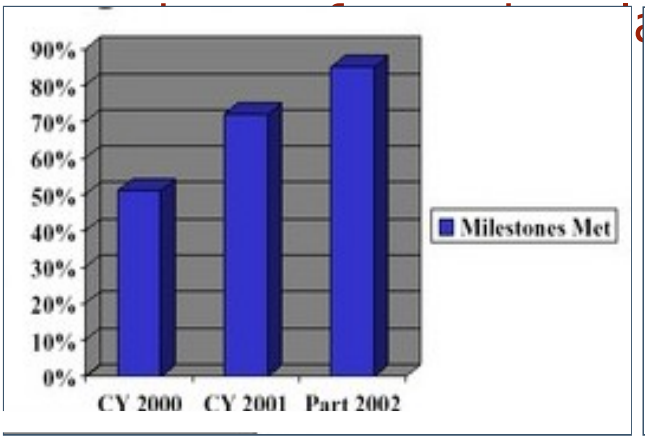
General Motors Corporation

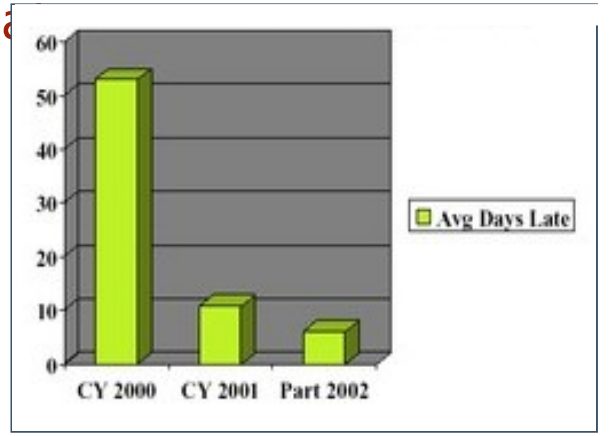
CMMI focus 2001

Goal is Integration of Supplier Work & GM Project Execution

Results:

- Improved schedule – projects met milestones





Schedule / cycle time

Camping on a Seesaw: GM's IS&S Process Improvement Approach. Hoffman, Moore & Schatz, SEPG 2003.

© 2003 by Carnegie Mellon University

Aggregated Appraisal Results

	Process Management			Project Management					Engineering						Support				
GG3	0%	0%	0%	0%	0%	10%	14%	0%	0%	0%	0%	0%	0%	0%	9%	0%	0%	0%	GG3
GG2	0%	0%	9%	0%	13%	33%	22%	14%	31%	44%	25%	50%	27%	36%	36%	36%	0%	0%	GG2
GG1	45%	18%	18%	0%	22%	44%	90%	24%	39%	50%	57%	81%	53%	50%	44%	44%	0%	0%	GG1
SG3					56%			41%		56%	100%	88%	88%			56%			SG3
SG2	45%	27%		100%	22%	61%	90%	65%		65%	86%	94%	53%	69%	63%	63%		31%	SG2
SG1	45%	27%	18%	0%	39%	50%	100%	24%	39%	72%	64%	94%	88%	59%	44%	63%	7%	0%	SG1
	OT	OPF	OPD	IPM	PP	PMC	SAM	RISK	RM	RD	TS	PI	VER	VAL	PPQA	CM	DAR	M&A	

Legend

Goals

- Generic Goal
- Specific Goal
- Process Areas of Immediate Concern

Goal Satisfaction

- Majority of organisations appraised achieved Goal Satisfaction
- Majority of organisations appraised did not achieve Goal Satisfaction
- Not Applicable

Results from 18 Defence Community* appraisals conducted over the period Mid 2000 - Present

- *Includes Defence Industry and Department of Defence appraisal results

(C) Copyright Commonwealth of Australia - September 2003
© 2003 by Carnegie Mellon University

In Summary

In today's fast-paced, competitive business environment, approaches used in the past such as "manufacturing in quality" and present, "engineering in quality" are not enough. The future is innovation. CMMI helps organizations to ...

- Improve delivery of performance, cost, and schedule
- Integrate stakeholders into project activities
- Provide competitive world-class products and services
- Implement an integrated enterprise business and engineering perspective
- Use common, integrated, and improving processes for systems and software

Upgrade to CMMI now... and lead the way to the future of process improvement.

© 2003 by Carnegie Mellon University

For More Information...

For more information about CMMI, see http://www.sei.cmu.edu/cmmi/

You can find more presentations like this on the SEI Web site at http://jo.sei.cmu.edu/pub/english.cgi/0/323123.

Or, contact
SEI Customer Relations
Phone: 412 / 268-5800
Email: customer-relations@sei.cmu.edu

© 2003 by Carnegie Mellon University

Summary

100 appraisals have been reported to the SEI in the 13 months since the April 2002 release of the SCAMPI Class A Version 1.1 appraisal method for CMMI Version 1.1

Relatively even reporting from the Commercial and DoD Contractor communities

Of U.S. organizations, the services and manufacturing industries reported most appraisals

Compared to the early reports of the SW-CMM maturity profile, the early data reflects a relatively more mature CMMI profile.

Additional information and charts will be added to this briefing as more appraisals are reported and therefore more data is available to support these breakdowns

© 2003 by Carnegie Mellon University